

PCT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 09 April 2001 (09.04.01)	
International application No. PCT/GB00/02970	Applicant's or agent's file reference 8.69747/001
International filing date (day/month/year) 31 July 2000 (31.07.00)	Priority date (day/month/year) 29 July 1999 (29.07.99)
Applicant FOLLESTAD, Arild et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

26 February 2001 (26.02.01)

☐ in a notice effecting later election filed with the International Bureau on:
2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Zakaria EL KHODARY Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 8.69747/001	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/ 02970	International filing date (day/month/year) 31/07/2000	(Earliest) Priority Date (day/month/year) 29/07/1999
Applicant MARSDEN, John Christopher et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

NONE☒ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

P/B 00/02970

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C08F10/00 C08F4/642 C08L23/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08F C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 57998 A (BOREALIS AS ; COCKBAIN JULIAN (GB); NENSETH SVEIN (NO); FOLLESTAD A) 23 December 1998 (1998-12-23) cited in the application examples 3,4 ---	1,4-11
X	WO 99 05153 A (TARGOR GMBH ; BINGEL CARSTEN (DE); FRAAIJE VOLKER (DE); KUEBER FRAN) 4 February 1999 (1999-02-04) examples 2,3 page 23, line 32 - line 44 page 24, line 13 - line 17 ---	1,4-11
X	WO 97 43323 A (DUN JOZEF J VAN ; MIYAMOTO AKIRA (JP); MATSUSHITA FUMIO (JP); CHUM) 20 November 1997 (1997-11-20) page 114; example 9; table 3 page 116; example 13; table 5 --- -/--	14,15



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* & * document member of the same patent family

Date of the actual completion of the international search

30 November 2000

Date of mailing of the international search report

11/12/2000

Name and mailing address of the ISA

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Authorized officer

Gamb, V

INTERNATIONAL SEARCH REPORT

International Application No

P/B 00/02970

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 528 523 A (MOBIL OIL CORP) 24 February 1993 (1993-02-24) page 11; example 6; table V ---	14, 15
X	EP 0 676 418 A (BP CHEM INT LTD) 11 October 1995 (1995-10-11) cited in the application page 9; example 14; table 2 ---	14
X	EP 0 398 350 A (IDEMITSU PETROCHEMICAL CO) 22 November 1990 (1990-11-22) page 6, line 3 - line 6 page 16; examples 11,12; table 3 ---	14
X	US 5 834 557 A (TSUTSUI TOSHIYUKI ET AL) 10 November 1998 (1998-11-10) column 41, comparative example 1 table 2 -----	14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02970

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9857998	A	23-12-1998	AU 8115798 A	04-01-1999
			AU 8222398 A	04-01-1999
			BR 9810154 A	08-08-2000
			BR 9810157 A	08-08-2000
			CN 1260807 T	19-07-2000
			CN 1260804 T	19-07-2000
			EP 0993478 A	19-04-2000
			EP 0991676 A	12-04-2000
			WO 9858001 A	23-12-1998
WO 9905153	A	04-02-1999	EP 1003757 A	31-05-2000
WO 9743323	A	20-11-1997	JP 9309926 A	02-12-1997
			AU 3131997 A	05-12-1997
			CA 2255754 A	20-11-1997
			CZ 9803728 A	17-03-1999
			EP 0898586 A	03-03-1999
			HU 9902561 A	29-11-1999
			NO 985329 A	15-01-1999
			PL 329949 A	26-04-1999
			ZA 9704269 A	16-11-1998
EP 0528523	A	24-02-1993	AU 661851 B	10-08-1995
			AU 1935492 A	28-01-1993
			CA 2074598 A	25-01-1993
			JP 5202129 A	10-08-1993
EP 0676418	A	11-10-1995	AT 194993 T	15-08-2000
			CA 2146208 A	08-10-1995
			DE 69518104 D	31-08-2000
			JP 8041118 A	13-02-1996
EP 0398350	A	22-11-1990	JP 1998352 C	08-12-1995
			JP 2305811 A	19-12-1990
			JP 7017710 B	01-03-1995
			CA 2017183 A	19-11-1990
			US 5494982 A	27-02-1996
US 5834557	A	10-11-1998	US 5708080 A	13-01-1998
			CA 2103380 A	20-05-1994
			EP 1050558 A	08-11-2000
			EP 0605952 A	13-07-1994
			JP 6207057 A	26-07-1994
			KR 132728 B	13-04-1998
			US 5464905 A	07-11-1995
			JP 6206941 A	26-07-1994
			KR 132766 B	13-04-1998

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 13 NOV 2001

WIPO PCT



Applicant's or agent's file reference 8.69747/001		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/02970	International filing date (day/month/year) 31/07/2000	Priority date (day/month/year) 29/07/1999	
International Patent Classification (IPC) or national classification and IPC C08F10/00			
Applicant BOREALIS TECHNOLOGY OY.			

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

- This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 26/02/2001	Date of completion of this report 09.11.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Adams, F Telephone No. +49 89 2399 8511 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02970

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-32 as originally filed

Claims, No.:

1-18 as received on 22/10/2001 with letter of 22/10/2001

Drawings, sheets:

1/8-8/8 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02970

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-18
Inventive step (IS)	Yes: Claims	
	No: Claims	1-18
Industrial applicability (IA)	Yes: Claims	1-18
	No: Claims	

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Ad V:

- 1). The present application does not satisfy the requirements set forth in Article 33(2) PCT because the subject-matter of the claims 1-18 is not new in respect of prior art as defined in the regulations (Rule 64(1)-(3) PCT).

WO-A-9857998 (D1) discloses a process for the preparation of an ethylene/1-hexene copolymer under constant temperature and pressure in a single reactor in the presence of a catalyst system comprising two coimpregnated metallocene catalysts, e.g. $(n\text{BuCp})_2\text{ZrCl}_2$ and $\text{rac-SiMe}_2(2\text{-methyl-4-phenyl-indenyl})_2\text{ZrCl}_2$ (cf. examples 3 and 4). As long as it is not clear from the claims what is to be understood under "polymer chain defect content" this feature can not be used to distinguish the present invention from the prior art. The feature, that "said metallocenes being selected to produce an olefin polymer comprising at least a higher molecular weight fraction and a lower molecular weight fraction" can also not be regarded as a limitation over the prior art as each single metallocene polymerization catalyst produces an olefin polymer comprising a higher molecular weight fraction and a lower molecular weight fraction.

- 2). The subject-matter of the present claims 1-18 is furthermore known from WO-A-9905153 (D2; cf. examples 2 and 3) and US-A-5834557 (D7; cf. preparation example 1).

The subject-matter of the present claims 13-18 is furthermore known from WO-A-9743323 (D3, cf. examples 9, 13 to 16), EP-A-0528523 (D4; cf. example 6), EP-A-0676418 (D5; cf. example 14) and EP-A-0398350 (D6; cf. examples 5-8, 11, 12). Claims 13-18 do not exclude polyolefins obtained by blending techniques and do also not exclude polyolefins obtained in a two-step polymerization process.

Ad VIII:

- 1). The term "having different propensities for incorporation of polymer chain defects" used in claim 1 is vague and unclear and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition

of the subject-matter of said claim unclear (Art. 6 PCT).

- 2). There should be a clear definition of the "polymer chain defect" in claims 1 and 13 (Art. 6 PCT).
- 3). Polymerization examples not falling under the scope of the invention using the catalysts A, B, D, F, H and I should be characterized as comparative examples (Art. 6 PCT). As none of the examples contains any information about the polymer chain defect content, it appears that there are no examples falling under the scope of the amended set of claims.
- 4). The feature "said metallocene being selected to produce an olefin polymer comprising at least a higher molecular weight fraction and a lower molecular weight fraction" is, firstly an attempt to define the invention by the result to be achieved which is not allowable in claims (Art. 6 PCT). More importantly, the feature is banal as almost any polymer catalyst produces polymers of different molecular weights separable into higher and lower weight fractions.

Claims:

1. A process for the preparation of an olefin polymer which comprises effecting olefin polymerisation under essentially constant conditions in a single reactor in the presence of a catalyst system comprising a support material coimpregnated with at least two metallocene olefin polymerisation catalysts having different propensities for incorporation of polymer chain defects.
2. A process as claimed in claim 1 wherein said metallocenes are selected to produce an olefin polymer comprising at least a higher molecular weight fraction and a lower molecular weight fraction, wherein the polymer chain defect content of said higher molecular weight fraction is at least 3 times that of said lower molecular weight fraction.
3. A process as claimed in claim 2 wherein said metallocenes are selected so that the polymer chain defect content of said higher molecular weight fraction is at least 10 times that of said lower molecular weight fraction.
4. A process as claimed in any preceding claim wherein at least one of said metallocenes comprises a group 4 metal.
5. A process as claimed in claim 4 wherein the catalyst system comprises at least a first metallocene selected from rac-dimethylsilyl bis(2-methyl-4-phenylindenyl)zirconium dichloride, bis(n-butylcyclopentadienyl)hafnium dichloride, ethyl bis(1-indenyl)hafnium dichloride and rac-dimethylsilyl bis(9-fluorenyl)zirconium dichloride and a second metallocene selected from bis(pentamethylcyclopentadienyl)zirconium dichloride, bis(n-butylcyclopentadienyl)zirconium

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dichloride and dimethylsilyl bis(9-fluorenyl)zirconium dichloride.

6. A process as claimed in any preceding claim wherein
5 the catalyst system further comprises a cocatalyst.
7. A process as claimed in claim 6 wherein said
cocatalyst is methyl aluminoxane.
- 10 8. A process as claimed in any preceding claim wherein
the support material is porous particulate silica.
9. A process as claimed in any preceding claim wherein
ethylene or propylene is polymerised.
15
10. A process as claimed in claim 9 wherein
polymerisation is effected in the presence of an α -
olefin comonomer containing up to 10 carbon atoms.
- 20 11. A process as claimed in claim 10 wherein ethylene
is copolymerised with 1-hexene.
12. A process as claimed in any preceding claim wherein
the olefin polymer is subsequently subjected to at least
25 one further polymerisation reaction.
13. A process as claimed in claim 12 wherein said
further polymerisation reaction comprises a process as
defined in claim 1.
30
14. A polyolefin having essentially complete particle
to particle homogeneity and comprising at least a higher
molecular weight fraction and a lower molecular weight
fraction, wherein the polymer chain defect content of
35 said higher molecular weight fraction is at least 3
times that of said lower molecular weight fraction.

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15. A polyolefin as claimed in claim 14 wherein the polymer chain defect content of said higher molecular weight fraction is at least 10 times that of said lower molecular weight fraction.
- 5
16. A polyolefin as claimed in claim 14 or claim 15 wherein the polymer chain defects are selected from side chains and crystallinity disrupting monomer units.
- 10
17. A polyolefin as claimed in claim 16 wherein the polymer chain defects comprise comonomer-derived short chain branches.
- 15
18. A polyolefin as claimed in claim 16 or claim 17 wherein the polymer chain defects comprise long chain branches containing at least 10 monomer units.
19. A polyolefin as claimed in claim 18 wherein said long chain branches are essentially homopolymeric.